

**On *Centropygus joseensis*, a Leech
from Brazil.**

By

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With 10 Text-figures.

DURING the Percy Sladen Expedition to Brazil in 1913 Professor J. P. Hill collected six specimens of land leeches, and while I was on leave from the Australian Imperial Force in France, and acting as Demonstrator in his department, he requested me to describe them. I was glad of this opportunity, for these leeches, themselves earthworm-like in appearance, were easy to determine as close relatives of *Lumbricobdella*, that interesting leech from Brazil, which has so closely copied the form and habit of an earthworm.

I have determined these specimens as

Centropygus joseensis (Grube et Oerstedt, 1859).

Syn. *Centropygos joseensis* (Grube et Oerstedt, 1859).

Centropygos jocensis (Grube et Oerstedt, 1859).

Cylicobdella lumbricoides (Grube, 1871).

Nephelis tergestina (R. Blanchard, 1892).

Liostomum joseense (Grube et Oerstedt, 1859; R. Blanchard, 1896).

In view of the want of any note (save Weber, 1914) on this leech, made in its natural state, the following extract from Professor Hill's diary is of value :

State of Rio, Brazil, at Government Orchard, Macieiras, altitude 1,500 metres. Found two species (?) of leeches, first

one under clod of earth coiled knot-like, bright red in colour darkening to the posterior end; second specimen under a stone. A third specimen found in earth on dislodging a buried log, darker in colour, and probably belongs to the same species as a fourth specimen, a much larger leech and slaty black in colour. On following day found two more land leeches similar to the first.

I have laid stress on this description, for the next year Weber (1914), describing certain leeches from Columbia as '*Centropygus joseensis*', for the first time mentions their blood-red colour.

The specimens collected by Professor Hill consist of five small and one larger leech. The former measure from 40 to 80 mm. long by 3 to 3.5 mm. in diameter—the latter single specimen is 130 mm. long by 7 mm. diameter.

HISTORICAL.

The genus *Centropygus* was first established by Grube in 1859 to contain a leech which Blanchard thinks came from San José near Panama, the generic name being given because the anus was erroneously supposed to open in the centre of the posterior sucker. In 1871 Grube described the genus *Cyclicobdella* in which he placed *C. lumbricoides*, a leech from Desterro.

Blanchard, who has examined these two types, found them to belong to the same species, and in this species placed also a leech described by him as *Nephelis tergestina*, and gave the generic name *Liostomum* priority.

Later, he restored the name *Centropygus* to the genus which contains *C. joseensis* from Trinidad, and another characterized by its blood-red colour described by Kennel in 1886 as *C. coccinea*, the colouring of *C. joseensis* being still unrecorded.

Kennel (1886) gave an excellent account of this species, and separated it from *C. lumbricoides* on certain anatomical details which I will mention later.

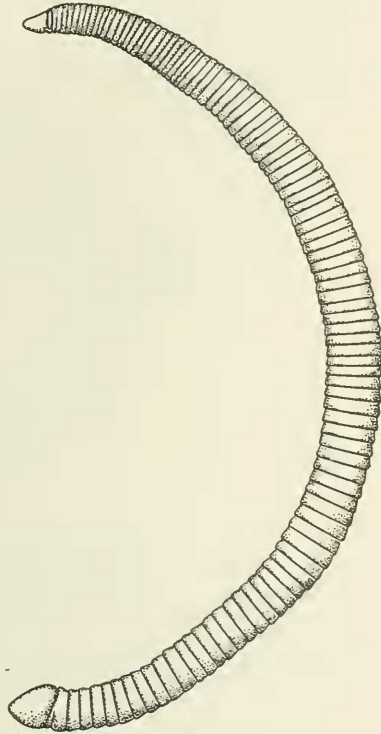
Weber (1914) was the first to record the colour of living specimens of *C. joseensis*, and for want of better informa-

tion he described the smaller of these specimens as *C. coccinea*. He laid stress on the fact that apart from size he could distinguish no difference in the specimens: the form, number of annuli, and the position of the genital pores were the same, small variations occurring in the number of annuli, as was already mentioned by Kennel (1886) and Blanchard (1896).

Kennel (loc. cit.) separated the species *C. coccinea* from *C. joseensis* for the following reasons: in *C. coccinea* the size is smaller, the ovaries lie ventral to the gut, between it and the nerve-chain, and the anterior part of the mid-gut has no blind sac at its transition into the mid-gut, whereas in *C. joseensis* as well as the greater size of the leech, the ovaries lie under the lateral blood-vessel and a blind sac is present. He admits that all the specimens of *C. coccinea* he examined were sexually immature, but does not think that this would account for the differences enumerated.

To determine the position of the specimens I dissected one, and cut serial sections of another, and I will be able largely to confirm Kennel's work and bring it up to date, especially as regards the relations of the ganglia and annuli, and to add certain new details.

TEXT-FIG. 1.

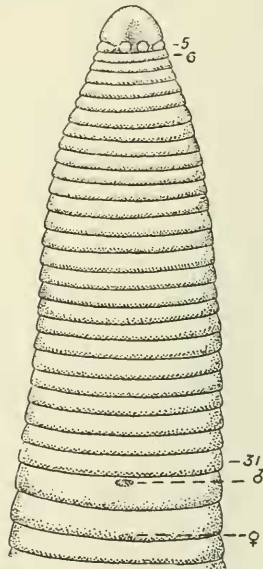


Lateral view of *C. joseensis* from a preserved specimen 42 mm. long.

DISTRIBUTION.

Blanchard (1896), describing members of this species collected by Borelli in Paraguay and Uruguay, says: 'This species is widely distributed in Central America, and has been collected in Rio de Janeiro, São Paulo, Pará, the basin of the Xingu,

TEXT-FIG. 2.



Anterior end of *C. joseensis* from the ventral surface to show the annulation and genital openings.

from San Bernardo, Paraguay, from Chiriqui (Central America), from Caracas, Puerto Cabello, Venezuela, Santa Catharina (Brazil), and Rio Grande do Sul.

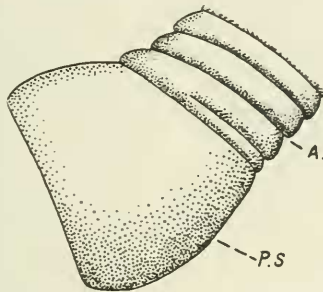
'This leech also extends very far towards the East. It is recorded from Antisana, Ecuador, that is to say to the very middle of the Eastern foothills of the Andes. Does this species cross the mountains, and is it found on the Western slope? Nothing is known to this effect yet, but it is not impossible since other species can live on either slope of the Cordillera.'

ANNULATION AND MEASUREMENTS.

In dealing with the annulation of these leeches it is necessary to define precisely the method adopted in the enumeration of the annuli. The earlier workers counted as first that annulus which completely surrounded the body, so that the male pore was given as opening between the 26th and 27th annuli.

To make their enumerations tally with those of recent workers, there must be added the four annuli on the dorsal surface of the anterior sucker and the annulus which is immediately below

TEXT-FIG. 3.

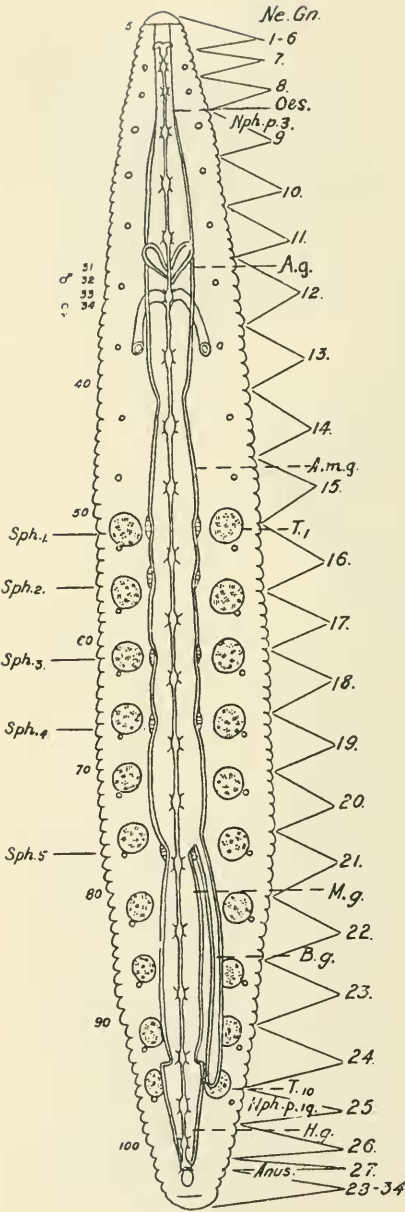


Lateral view of the posterior end of *C. joseensis*. *A.*, position of anus. *P.s.*, posterior sucker.

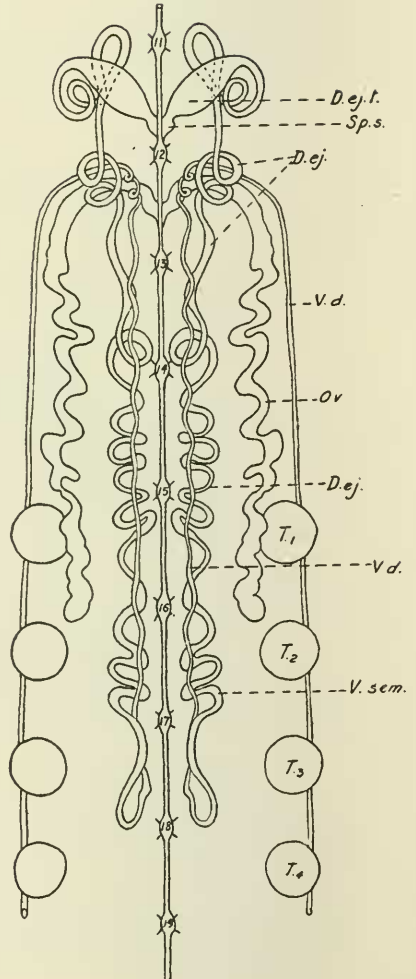
these divisions but is incomplete ventrally, where it forms the lateral boundaries of the mouth cavity.

Again, in regard to the position of the anus, which both Blanchard and Kennel show as between the annuli which are second and third from the posterior sucker, I find that in only two of my specimens is there any indication of the last annulus which marks the dorsal surface of the posterior sucker (Text-fig. 3).

I have shown in Text-fig. 4 the relations of the nerve ganglia to the annuli, and defined the somites on a neuromeric basis. This figure is drawn from the dissection of a specimen 80 mm. long, and certain details added from the serial sections of a specimen 60 mm. in length. The six specimens which I examined ranged in length from 40 to 130 mm., and in breadth from 3 to 7 mm.



TEXT-FIG. 4.



TEXT-FIG. 5.

TEXT-FIG. 4.

Diagram of *Centropygus joseensis* showing the annuli and their relation to the nerve ganglia, the somite limits, the alimentary reproductive and nephridial systems as seen from the dorsal surface of a dissected specimen. *Ne.gn.*, nervia ganglia and somite limits. *Nph.p.* 3, nephridiopore 3, &c. *Nph.p.* 19, nephridiopore 19. *Oes.*, oesophagus. *A.g.*, anterior gut. *A.m.g.*, anterior portion of mid-gut. *M.g.*, mid-gut. *H.g.*, hind-gut. *B.g.*, blind pouch of anterior portion of mid-gut. *Sph.*, &c., sphincters of anterior part of mid-gut. *T.*, testes, first pair. 31, 32, male opening. 33, 34, female opening.

TEXT-FIG. 5.

Diagram of the reproductive system of *Centropygus joseensis* as seen from the dorsal surface of a dissected specimen. *T.*, first pair of testes, &c. *V.d.*, vas deferens. *V.sem.*, vesicula seminalis. *D.ej.*, ejaculatory canal. *D.ej.t.*, terminal portion of ejaculatory canal. *Sp.s.*, spermatophore sac. *Ov.*, ovary. 11, 12, &c., nerve ganglia.

The total number of annuli varies from 102 to 104. In all the male pore is placed between the 31st and 32nd annulus, and the female between the 33rd and 34th annulus (Text-fig. 2).

ALIMENTARY SYSTEM.

The mouth placed at the base of the spoon-shaped anterior sucker is bounded in preserved specimens by two well-marked lobes, which abut on the ventral ends of the 5th annulus (Text-fig. 2). These lobes are a very characteristic feature in all the preserved specimens I have examined; but an examination of sections leads me to believe that they are partly of an oedematous nature—several longitudinal folds furrow the concavity of the anterior sucker.

The pharynx has a well-developed musculature of longitudinal circular and radial fibres, and from it the oesophagus extends and passes into the anterior gut which in its turn gives place to the anterior portion of the mid-gut in the 14th somite. There is a narrowing of the lumen at this point caused by convolutions of this part of the gut. The anterior part of the mid-gut extends to the 21st somite; its relations to other structures, the sphincters surrounding it, and the blind-gut which arises from it are shown in Text-fig. 4 (*Sph.*₁₋₅, *B.g.*).

These last two features—the sphincters and the blind-gut—are of considerable importance in distinguishing *C. joseensis* from *C. coccinea*. There are five sphincters, one placed at the end of each somite from the 15th to the 18th; the 5th sphincter is in the 21st somite immediately behind the blind-gut (Text-fig. 4, *Sph.*₁₋₅). Each consists of a layer of circular muscle-fibres surrounding the gut; in preserved specimens, being relaxed, they produce little constriction. The sphincter in the 21st somite is particularly well developed.

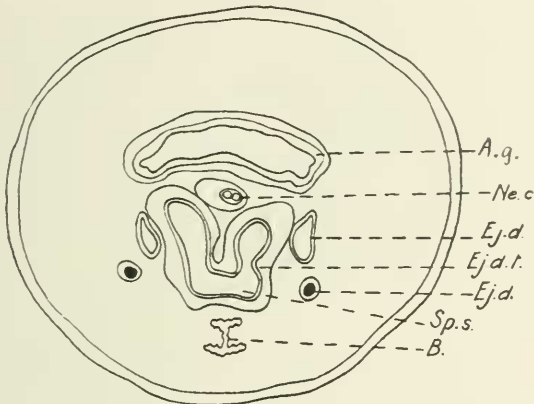
Another feature of systematic importance is the development of a single blind-gut which occurs in *C. joseensis* but not in *C. coccinea*. This is given off at the termination of the anterior portion of the mid-gut in the 21st somite; it extends to the 24th somite, lying to the right of the mid-gut. Kennel (1886) figures the blind-gut as coming off on the right

of the anterior part of the mid-gut, but I have seen it coming off on the left in a specimen of 60 mm.

In structure the blind-gut resembles the anterior part of the mid-gut, of which it appears to be a backward prolongation, but no lymph spaces surround it and its circular musculature is better developed (Text-fig. 9, *B.g.*).

The mid-gut extends from the 20th somite to the beginning of the 24th somite; it is not surrounded by a lymph space

TEXT-FIG. 6.



Transverse section of *Centropygus joseensis* at the level of the male opening, showing the junction of the two horns of the terminal portions of the ejaculatory duct to form the spermatophore sac and parts in relation thereto. ($\times 30$.) *A.g.*, anterior gut. *Ne.c.*, nerve-cord in ventral lacuna. *Ej.d.*, ejaculatory duct. *Ej.d.t.*, terminal portion of ejaculatory duct. *Sp.s.*, spermatophore sac. *B.*, male bursa.

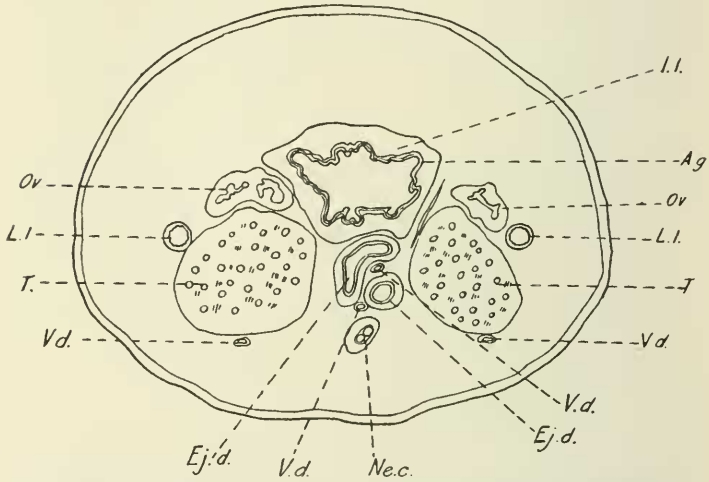
like its anterior part. At its termination on the 24th somite there is a sphincter which separates it from the hind-gut. The anus is placed above the 27th nerve ganglion.

REPRODUCTIVE SYSTEM.

There are ten pairs of testes, a pair being placed within the 1st and 2nd annulus in each somite from the 16th to the 25th (Text-figs. 4, 5, *T.*₁, &c.). Kennel (*loc. cit.*) states that he has found twelve pairs of testes, but in my serial sections of a

60 mm. specimen and in a dissection of an 80 mm. specimen there are only ten pairs. Still, it is not an uncommon thing in leeches for a pair or more testes to be wanting, and Kennel shows in his figure that the 1st and 3rd testis of the right side are wanting. Each vas deferens lies ventral to the testes and runs anteriorly from somite 25 to somite 12; here it turns medially and then runs posteriorly to the 18th somite, where

TEXT-FIG. 7.



Transverse section of *C. joscensis* at the level of the 16th somite, showing the relation of the various systems. ($\times 30$). *I.l.*, intestinal lacuna of the anterior portion of the mid-gut. *Ov.*, ovary. *L.l.*, lateral lacuna. *T.*, testes, first pair. *V.d.*, vas deferens ascending part under testis, descending part ventral to ejaculatory duct. *Ej.d.*, ejaculatory duct. *Ne.c.*, nerve-cord.

it turns and passes forward as the vesicula seminalis, a convoluted tube packed with sperms, which lies with the vas deferens in connective tissue dorsal to the ventral lacuna. The vesicula seminalis develops muscular walls and becomes the ejaculatory duct in somite 15. The ejaculatory duct of either side pursues a convoluted course until it reaches its glandular terminal portion; this part joins with its fellow and their distal ends form the spermatophore sac which opens into the male bursa (Text-fig. 6, *Sp.s.*).

The ovaries (Text-figs. 5, 7, *Ov.*) are placed in a connective tissue which lies close to the testes. They are much convoluted and extend on either side from somite 12 to somite 16; anteriorly they unite at the female atrium.

This reproductive system shows certain affinities with that of other *Herpobdellids*, but there is not seen the conducting tissue as described by Brumpt (1899) for *H. atomaria*.

NEPHRIDIA.

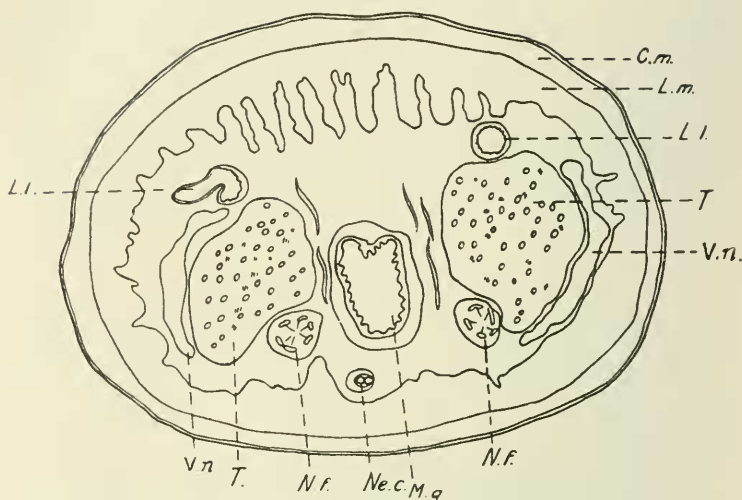
There are nineteen pairs of nephridia placed in somites 7 to 25. As usual the nephridiopores open on the latero-ventral aspect of the annulus preceding that in which the nerve ganglion lies.

The general structure of the nephridium follows that seen in other members of the *Herpobdellidae*.

Ciliated funnels have not previously been found in *Centropygus joseensis*. Kennel was unable to find them; he says that 'in spite of careful examination of serial sections I have never seen a picture which would allow one to conclude the presence of a widely open funnel, and if any opening exists it should be fairly narrow'. These ciliated organs are found in each somite, and in the testicular region one is placed in a dilatation of a branch of the lateral lacuna (lateral blood-vessel of early authors) which lies immediately ventral to each testis (Text-fig. 8, *N.f.*).

The structure of the ciliated organ in this leech has some resemblance to that of *Nephelis* as figured and described by Graf (1899). A comparison of a transverse section of a ciliated funnel of *C. joseensis*, as shown in Text-fig. 10, with Graf's figures of the ciliated organ of *Nephelis quadrostriata*, shows the similarity of these organs. The terminal vesicle of each nephridium is particularly well developed and lies on either side at the level of the nerve ganglion in relation to it; portion of the lumen of the vesicle is taken up by the bulging into it of the testis.

TEXT-FIG. 8.



Transverse section of *C. joseensis*, in the 20th somite, showing the position and relative size of the nephridial funnels. ($\times 30$.) *C.m.*, circular muscle layer. *L.m.*, longitudinal muscle layer. *L.l.*, lateral lacuna. *T.*, testes, fifth pair. *V.n.*, terminal vesicle of nephridium. *N.f.*, nephridial funnel. *M.g.*, anterior portion of mid-gut. *Ne.c.*, nerve-cord in ventral lacuna.

TEXT-FIG. 9.

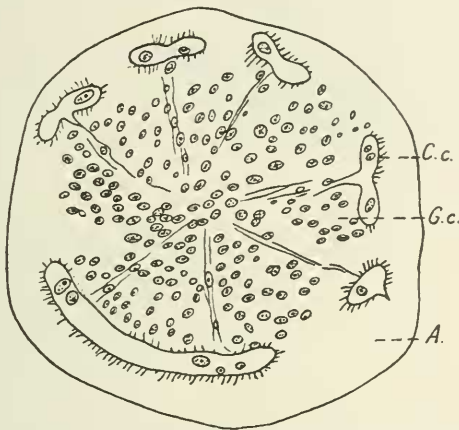


Transverse section of *C. joseensis* in the 22nd somite, showing the relation of the blind-gut to the middle-gut. ($\times 30$.) *C.m.*, circular muscle layer. *Epi.*, epidermis. *L.m.*, longitudinal muscle layer. *D.l.l.*, dorsal branch of lateral lacuna. *L.l.*, lateral lacuna. *V.n.*, terminal vesicle of nephridium. *B.g.*, blind-gut. *M.g.*, middle-gut. *Ne.c.*, nerve-cord in ventral sinus.

COELOMIC SYSTEM AND ITS MODIFICATIONS.

The lateral lacunae (lateral blood-vessels of authors before Oka (1912)) extend throughout the body, being much reduced at either end; in each somite there are regularly arranged communications dorsally between the lateral lacunae and ventrally with the ventral lacuna (Text-fig. 9, *L.l.*). There is no dorsal lacuna and this is absent also in other Herpobdellids, and the ventral lacuna is small and contains only the

TEXT-FIG. 10.



Transverse section of a ciliated funnel of *C. joseensis*, showing the ciliated crown cells and the granular cells. *C.c.*, ciliated crown cell. *G.c.*, granular cells. *A.*, ampulla.

nerve-cord and ganglia and forms no expansion anteriorly to contain the reproductive organs.

SENSE ORGANS.

These consist of a series of flask-shaped organs chiefly arranged along the edge of the oral sucker. They have been described and figured by Kennel (1886), and I have nothing to add to his description.

I wish to thank Professor J. P. Hill, of University College, London, for his kindly assistance whilst engaged in this work in his department.

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